FORM PTO-1390 (REV 11-98)	U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 30-516
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U S APPLICATION NO (If known, see 37 C.F.R. 1 5) 09/508463 Unknown
INTERNATIONAL APPLICATION NO. **PCT/FI98/00737**	INTERNATIONAL FILING DATE **18 September 1998**	PRIORITY DATE CLAIMED **18 September 1997**

TITLE OF INVENTION
PRESSURE LOADED PANEL AND USE FOR BOAT AND CONTAINER CONSTRUCTION

APPLICANT(S) FOR DO/EO/US
BERGSTRÖM et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. To 16. Below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information.

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/508463 Unknown	PCT/FI98/00737	30-516

17. ☒ The following fees are submitted:

	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5):	
-- Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $970.00	
-- International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $840.00	
-- International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2) paid to USPTO $760.00	
-- International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $670.00	
-- International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $96.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 970.00
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 0.00

CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE			
Total Claims	**20**	-20 =	0	X	$18.00	$	0.00
Independent Claims	**1**	-3 =	0	X	$78.00		0.00
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)				+$260.00		$	0.00
				TOTAL OF ABOVE CALCULATIONS =		$	**970.00**
Reduction by ½ for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).							0.00
				SUBTOTAL =		$	**970.00**
Processing fee of $130.00, for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).					+		0.00
				TOTAL NATIONAL FEE =		$	**970.00**
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property					+	$	40.00
Fee for Petition to Revive Unintentionally Abandoned Application ($1,210 – Small Entity Fee = $605)						$	0.00
				TOTAL FEES ENCLOSED =		$	**1010.00**
					Amount to be: refunded	$	
					charged	$	

a. ☒ A check in the amount of $1010.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. 14-1140 in the amount of $_____ to cover the above fees. A duplicate copy of this form is enclosed.
c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1140. A duplicate copy of this form is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SIGNATURE

SEND ALL CORRESPONDENCE TO:

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Robert A. Vanderhye
NAME

27,076 **March 10, 2000**
REGISTRATION NUMBER Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

BERGSTRÖM et al

Atty. Ref.: **30-516**

Serial No. **Unknown**

Group:

Filed: **March 10, 2000**

Examiner:

For: **PRESSURE LOADED PANEL AND USE FOR BOAT AND CONTAINER CONSTRUCTION**

* * * * * * * * * * * *

March 10, 2000

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

Prior to calculation of the filing fee and in order to place the above identified application in better condition for examination, please amend the above identified application as follows:

IN THE TITLE

Amend the title to read:

-- **PRESSURE-LOADED PANEL AND USE FOR BOAT AND CONTAINER CONSTRUCTION** --.

IN THE SPECIFICATION

Page 1, after the title and before the first line of specification insert the following:

-- **CROSS REFERENCE TO RELATED APPLICATION**

This application is a U.S. national phase of PCT application No. PCT/FI98/00737, filed September 18, 1998.

BACKGROUND AND SUMMARY OF THE INVENTION --.

Page 3, at line 25 (before the last paragraph on the page), insert the following:

-- **BRIEF DESCRIPTION OF THE DRAWINGS** --.

Page 4, after line 3, insert the following:

-- **DETAILED DESCRIPTION** --.

IN THE ABSTRACT

Provide what is on the attached sheet as the Abstract.

IN THE CLAIMS

Cancel claims 1 through 9 without prejudice.

Add the following new claims:

-- 10. A panel having a longer side and a shorter side, and a side aspect ratio of at least 1.5, and comprising:

at least two reinforcing layers of substantially unidirectional substantially parallel fibers having predominant orientations that form an angle with said sides of said panel;

said angle between said predominant fiber orientation and the longer side of said panel being between about 55-75°; and

approximately one-half of said reinforcing layers of said panel forming a + angle between about 55-75°, and approximately one-half of said reinforcing layers forming a - angle between about 55-75°, with respect to said longer side of said panel.

11. A panel as recited in claim 10 wherein said angle is between about ±58-65°.

12. A panel as recited in claim 10 wherein said angle is about ±60°.

13. A panel as recited in claim 10 wherein said at least two reinforcement layers comprise 60-100% of the thickness of said panel.

14. A panel as recited in claim 10 wherein at least two of said layers, at least one of which has fibers with a + orientation and at least one of which has a - orientation, are stitched together to form a multi-axial reinforcement.

15. A panel as recited in claim 14 wherein about 70-100% of the thickness of said panel is formed by multi-axial reinforcements.

16. A panel as recited in claim 10 wherein said fibers of said at least two layers of said panel consist essentially of E-glass fibers.

17. A panel as recited in claim 10 wherein said fibers of said panel comprise primarily E-glass fibers.

18. A panel as recited in claim 11 wherein at least two of said layers, at least one of which has fibers with a + orientation and at least one of which has a - orientation, are stitched together to form a multi-axial reinforcement.

19. A panel as recited in claim 12 wherein at least two of said layers, at least one of which has fibers with a + orientation and at least one of which has a - orientation, are stitched together to form a multi-axial reinforcement.

20. A panel as recited in claim 19 wherein about 70-100% of the thickness of said panel is formed by multi-axial reinforcements.

21. A panel as recited in claim 18 wherein about 70-100% of the thickness of said panel is formed by multi-axial reinforcements.

22. A panel as recited in claim 11 wherein said fibers of said at least two layers of said panel consist essentially of E-glass fibers.

23. A panel as recited in claim 22 wherein said at least two reinforcement layers comprise 60-100% of the thickness of said panel.

24. A boat or ship having a hull with a plurality of laterally pressure loaded structural panels as recited in claim 10.

25. A boat or ship having a hull with a plurality of laterally pressure loaded structural panels as recited in claim 18.

26. A boat or ship hull as recited in claim 24 wherein said panels have approximately 10% less weight but substantially the same ability to resist lateral pressure loads than if constructed of otherwise identical panels with an angle between said predominant fiber orientations and the longer side of said panels of 0°, 90°, or 45°.

27. A tank or pressure vessel having a plurality of laterally pressure loaded structural panels as recited in claim 10.

28. A tank or pressure vessel having a plurality of laterally pressure loaded structural panels as recited in claim 21.

29. A tank or pressure vessel as recited in claim 27 wherein said panels have approximately 10% less weight but substantially the same ability to resist lateral pressure loads than if constructed of otherwise identical panels with an angle between said predominant fiber orientations and the longer side of said panels of 0°, 90°, or 45°. --.

REMARKS

Entry of the above requested amendments is requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____

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ABSTRACT OF THE DISCLOSURE

A substantially laterally pressure-loaded panel has a side aspect ratio of at least 1.5, is formed of at least two reinforcement layers of substantially unidirectional fibers. The predominant orientations of the fibers form an angle of between about ±55° - ±75° (preferably about 60°) with the longer side of the panel, with about one-half of the layers having a positive (+) angle and about one-half a negative (-) angle, within the range. The panel preferably has about 60-100% of its thickness formed by the reinforcement layers. The panels can be used in boat and/or shipbuilding structural panels, pressure-loaded tanks, pressure-vessels and other corresponding structures that are subjected to a lateral pressure load.

PRESSURE-LOADED PANEL AND USE OF IT AT BOAT OR CONTAINER CONSTRUCTIONS

The present invention relates to a substantially laterally pressure-loaded reinforced plastic plate with improved properties, e.g. a rectangular or trapezoidal area defined by stiffeners in the hull of a boat, a panel, the side aspect ratio of which, i.e. the relation of the longer sides to the shorter sides, is at least 1.5. In the following, this area is referred to as a panel, irrespective of whether it is positioned in the hull of a boat or used in some other embodiment as a laterally pressure-loaded reinforced plastic plate.

Traditional woven reinforcements are composed of threads that are positioned at an angle of 0° and 90° with respect to each other and bound to each other and interlace according to the desired weaving pattern.

On the market there are new kinds of stitched reinforcement products, i.e. so-called multi-axial reinforcements that may be biaxial, triaxial and quadriaxial with fibre orientations in two, three or four directions in relation to each other respectively. They differ from traditional woven reinforcements at least so that the reinforcement threads form straight unidirectional fibre layers which do not cross the threads of another direction and which layers are typically bound to each other with a thin stitching yarn and so that the threads of individual layers are typically either at an angle of ±45 or 0°/90° with respect to the longitudinal axis of the reinforcement. Multi-axial reinforcements of this type are commonly used in boat laminates and consequently, in boat panels.

The purpose of the invention is to create an improved, substantially laterally pressure-loaded reinforced plastic plate, i.e. a panel, with a side aspect ratio at least 1.5. The purpose of our invention is thus to come up with a solution that among other things improves the mechanical properties of a pressure-loaded reinforced plastic plate, i.e. a panel, so that both the deflection and the stress level decrease in comparison with a laminate that is reinforced at an angle of 0°/90° or ±45° with respect to the longer side of the panel.

The characteristic features of a substantially laterally pressure-loaded reinforced plastic plate, i.e. a panel, according to the invention are disclosed in the characterising portions of the appended patent claims.

In connection with this invention, term reinforcement layer is used to refer such layers of a panel that function as active reinforcing elements. For instance, in the surface layers it is possible to use layers that give the optimal properties as regards the desired surface quality, but which layers may have a reinforcing effect that deviates from the optimal effect. For example, chopped strand mat may be used as surface layers of this kind. An individual reinforcing layer is formed of a so-called unidirectional reinforcement layer, i.e. a reinforcement layer of substantially parallel fibres. Individual reinforcing layers can be used to create so-called multi-axial reinforcements, the use of which facilitates and accelerates the assembly of an entire reinforcement structure.

The basic idea of our invention is the realization that the reinforcements (where the threads of individual layers are arranged typically either at an angle of ±45° or 0°/90° with respect to the longitudinal axis of the reinforcement) in the laterally pressure-loaded reinforcement plates i.e. panels used nowadays may be positioned in a new way in the panel, and consequently, the result would be a panel equal in weight as before. This new panel structure would, however, have better mechanical properties than before. What is meant with improved mechanical properties here is that in a lateral state of pressure, the deflection and the stress level of a panel according to the invention decrease in comparison with a panel constructed in some previously known manner. This kind of panel constructed in any known manner is formed of reinforcement layers that are positioned e.g. at an angle of 0°/90° or ±45° in respect of the longer side of the panel. In the following, the term basic laminate is used to refer to a structure of reinforcement layers constructed in this way. The basic laminate structure is used nowadays for example in boat panels.

The idea according to the invention has later been tested with new calculation methods by using contrary to usual practice a non-linear analysis and element method which require an exceptionally great calculation capacity.

According to our inventive idea we started testing new kinds of panel constructions, where different side aspect ratios were selected for the pressure-loaded panel and the angle between fibre layers were changed.

By using the new kind of multi-axial reinforcement it is possible to improve the mechanical properties of a pressure-loaded reinforced plastic plate so that in the state of lateral pressure both the deflection and the stress level decrease in comparison with a panel constructed in some previously known manner. We detected that for a typical boat laminate and a load on a boat, the optimal fibre angle is between 55° and 90° with a great side aspect ratio.

The advantages of the laminate according to the invention are e.g. a reduction in the failure index by 10 % in comparison with the failure index of the basic laminate, an increase in stiffness by 5-10 % in comparison with the basic laminate, and consequently, a weight saving of approx. 10 % in the final product, i.e. the boat hull laminate, if its mechanical properties are to be kept unchanged. The failure index illustrates the measurement of stress level in each layer. If the failure index is below 1, the stress levels in a layer are below the highest allowed level. The first failure occurs when the failure index reaches the value of 1.

In the following, the laterally pressure-loaded reinforced plastic plate according to the invention is described in detail by referring to the enclosed figures, of which

Figure 1 shows schematically a traditional woven roving and a multi-axial reinforcement (of which a biaxial version is disclosed in the figure),

Figure 2 illustrates the plates used in the study and particularly, the fibre angles and side aspect ratios thereof,

Figures 3-6 illustrate the deflection of the pressure-loaded reinforced plastic plates and the greatest failure index in the laminate with side aspect ratios of 1.0, 1.5, 2.0 and 3.0.

The research that was initiated based on this invention concentrated on studying by calculating both the effect of fibre orientation and the side aspect ratio of the plate used in the study on the deflection and the stresses of the laminate. The element method was used to calculate the behaviour of the panel with various side aspect ratios and various orientations of reinforcement fibres with respect to the long side of the panel. A typical boat laminate that contains partly multi-axial woven reinforcement material and chopped strand mat of E-glass in the surfaces was chosen as an example in the study. In calculations, e.g. E-glass was used as multi-axial reinforcement material. Also other materials may be used either as the only material or a partial material in the multi-axial reinforcement or in individual unidirectional reinforcement layers.

Said laminate is symmetrical in relation to the centre plane. The first and the last layers consist of chopped strand mat (300 g/m^2) and in between, there are four layers of multi-axial woven reinforcement (920 g/m^2). The following stiffness values and strength values were used in the study:

Chopped strand mat 300:

fibre content	[Vol.-%]	20
fibre content	[mass-%]	35
E	[GPa]	9.7
G	[GPa]	3.6
v	[-]	0.325
t	[mm]	0.6
σ, tensile	[MPa]	120
σ compressive	[MPa]	150
τ	[MPa]	70

A half a layer of fabric 920:

fibre content	[Vol.-%]	40
fibre content	[mass-%]	59
E_1	[GPa]	28.0
E_2	[GPa]	8.4
G_{12}	[GPa]	5.2
ν_{12}	[-]	0.06
ν_{21}	[-]	0.2
t	[mm]	0.45
$\sigma_{1\text{-tensile}}$	[MPa]	480
$\sigma_{1\text{-compressive}}$	[MPa]	400
$\sigma_{2\text{-tensile}}$	[MPa]	40
$\sigma_{2\text{-compressive}}$	[MPa]	140
τ_{12}	[MPa]	35

Table 1: The stiffness and strength values of different layers. Subindex "1" stands for "in the direction of the fibres" and subindex "2" for "perpendicularly to the fibre orientation".

In the study the length of the short side of the panel was always 0.5 m. The 0°/90° laminate was analysed for the sake of comparison. It represents the fibre orientations of the traditional woven roving.

According to the study, thin pressure-loaded reinforced plastic plates behave non-linearly, i.e. with a high pressure load the deflection does not increase linearly with the

load. In order to achieve reliable results this feature has to be taken into account by performing a non-linear analysis.

The non-linear static analysis of this study was performed by using NASTRAN 66 finite element program and a non–linear solver giving a suitable material model for reinforced plastic structures. The calculations were run on a CRAY X-MP super computer.

The boundary conditions and material values used in all plates were identical. All the edges were supported by joint structures so that all rotations were free and displacements fixed. The panels were loaded with a uniform pressure of 30 kPa. In practice, this value corresponds to wave slamming load in a small boat.

In the results the greatest deflection in the panel and the greatest failure index of the laminate were studied (according to the Tsai-Wu theory). The failure index illustrates the measurement of the stress level in each layer. If the failure index is below 1, the stress levels in a layer are smaller than the allowed level. The first failure occurs when the failure index reaches the value of 1.

The results are presented in Figures 3-6.

Figure 3 shows that with the side aspect ratio of 1, the effect of fibre orientations on the deflection is fairly small. With respect to the failure index, the fibre orientations of ±45° are the most preferable.

Figures 4 to 6 show that the behaviour of the panel is practically identical with side aspect ratios greater than 1.5. The smallest value of deflection is reached with the fibre orientation of 90°. The failure index is smallest with the fibre orientations of ±60°. In practice it can be noticed that the fibre orientations of ±55° - ±75° are applicable, preferably ±58° - ±65°, even though according to the figures, the best result is reached with the fibre orientation of ±60°.

Deflection of the plate :

The optimal fibre angle with a great side aspect ratio is between 75° and 90°. In comparison with the 0°/90° and ±45° laminate, the differences in deflection are in the range of 10 % with a great range of side aspect ratio. The differences are small with the side aspect ratio of 1.

Failure index:

In all examples the failure index is greatest in the second layer, i.e. in the first reinforcement layer in the inside of the panel (on the side of the tension). The optimal fibre angle is between 60°-90°, except with the side aspect ratio of 1 when it is 45°. Compared with the 0°/90°-laminate, the failure index decreases approximately by 15 %.

The invention relates to a substantially laterally pressure-loaded panel, the side aspect ratio of which being at least 1.5 and which panel being comprised at least of two reinforcement layers of substantially parallel fibres, i.e. unidirectional reinforcement layers, the predominant orientations of which form an angle with respect to the sides of the panel. Good results have been achieved, when the angle between the predominant fibre orientation of the unidirectional reinforcement layer and the longer side of the panel is approx. ±55° - ±75°, preferably approx. ±58° - ±65°, more preferably approx. ±60°, and when approximately one half of the unidirectional reinforcement layers used in the thickness of the panel forms a desired + -angle with the longer side of the panel and correspondingly, approximately the other half forms a desired — -angle with the longer side of the panel.

In an embodiment of the invention, a substantial part of the thickness of the panel and preferably 60-100 %, more preferably more than 70 % of the thickness of the panel, is composed of reinforcement layers that are formed of substantially parallel fibres, i.e. unidirectional reinforcement layers, the predominant orientations of said reinforcement layers forming with the longer side of the panel an angle of approx. ±55° - 75° and

preferably approx. ±58° - 65°, more preferably approx. ±60°. Further, approximately one half of the unidirectional reinforcement layers used in the thickness of the panel forms a desired + -angle with the longer side of the panel and correspondingly, approximately the other half forms a desired — -angle with the longer side of the panel.

In another embodiment of the invention at least two of the reinforcement layers of the panel are attached to each other by means of stitching, whereby these layers form a multi-axial reinforcement.

In an embodiment of the invention a substantial part of the thickness of the panel and preferably 60-100 % and more preferably more than 70 % of the thickness of the panel is composed of reinforcement layers of multi-axial reinforcements.

Pressure-loaded panels in accordance with the invention are preferably manufactured substantially of fibres of E-glass. Also other reinforcement fibre materials can be used as a partial material or as the only material in different reinforcement layers in the panel or in multi-axial reinforcements.

Panels in accordance with the invention can preferably be used in boat and/or shipbuilding and also in other pressure-loaded tanks, pressure vessels and other corresponding structures that are subjected to a lateral pressure load.

CLAIMS

1. A substantially laterally pressure-loaded panel, the side aspect ratio of which is at least 1.5 and which is composed at least of two reinforcement layers of substantially parallel fibres, i.e. unidirectional reinforcement layers, the predominant orientations of said reinforcement layers forming an angle with the sides of the panel, **characterised** in that in the unidirectional reinforcement layer the angle between the predominant fibre orientation and the longer side of the panel is approx. ±55° - ±75° and that approximately one half of the unidirectional reinforcement layers used in the panel forms a desired +-angle with the longer side of the panel and approximately the other half forms a desired – -angle with the longer side of the panel.

2. A pressure-loaded panel in accordance with claim 1, **characterised** in that the angle between the predominant fibre orientation of the unidirectional reinforcement layer and the longer side of the panel is approx. ±58° - ±65° and that approximately one half of the unidirectional reinforcement layers used in the thickness of the panel forms a desired +-angle with the longer side of the panel and correspondingly, the other half forms a desired —angle with the longer side of the panel.

3. A pressure-loaded panel in accordance with claim 1, **characterised** in that the angle between the predominant fibre orientation of the unidirectional reinforcement layer and the longer side of the panel is approx. ±60° and that approximately one half of the unidirectional reinforcement layers used in the thickness of the panel forms a desired +-angle with the longer side of the panel and correspondingly, the other half forms a desired —angle with the longer side of the panel.

4. A pressure-loaded panel in accordance with any of claims 1-3, **characterised** in that a substantial part of the thickness of the panel and preferably 60 – 100 % and more preferably over 70 % of the thickness of the panel is formed of reinforcement layers that are substantially comprised of unidirectional fibres, i.e. unidirectional reinforcement layers, the predominant orientations of said reinforcement layers forming with the longer

side of the panel an angle of approximately ±55°-75°, preferably approximately ±58°-65, more preferably approximately ±60° and that approximately one half of the unidirectional reinforcement layers used in the panel thickness forms a desired +-angle with the longer side of the panel and correspondingly, approximately the other half forms a desired — angle with the longer side of the panel.

5. A pressure-loaded panel in accordance with any of claims 1-4, **characterised** in that at least two of the reinforcement layers of the panel are attached to each other by stitching whereby these two layers form a multi-axial reinforcement.

6. A pressure-loaded panel in accordance with claim 6, **characterised** in that an essential part of the thickness of the panel, preferably 60-100 %, more preferably over 70 % of the thickness of the panel is formed of reinforcement layers of multi-axial reinforcements.

7. A laterally pressure-loaded panel in accordance with any of the preceding claims, **characterised** in that it is manufactured substantially of fibres made of E-glass.

8. Use of a laterally pressure-loaded panel in accordance with any of claims 1-7 in boat and/or shipbuilding.

9. Use of a laterally pressure-loaded panel in accordance with any of claims 1-7 in tanks, pressure vessels and in other corresponding structures that are subjected to a lateral pressure load.

Fig. 1

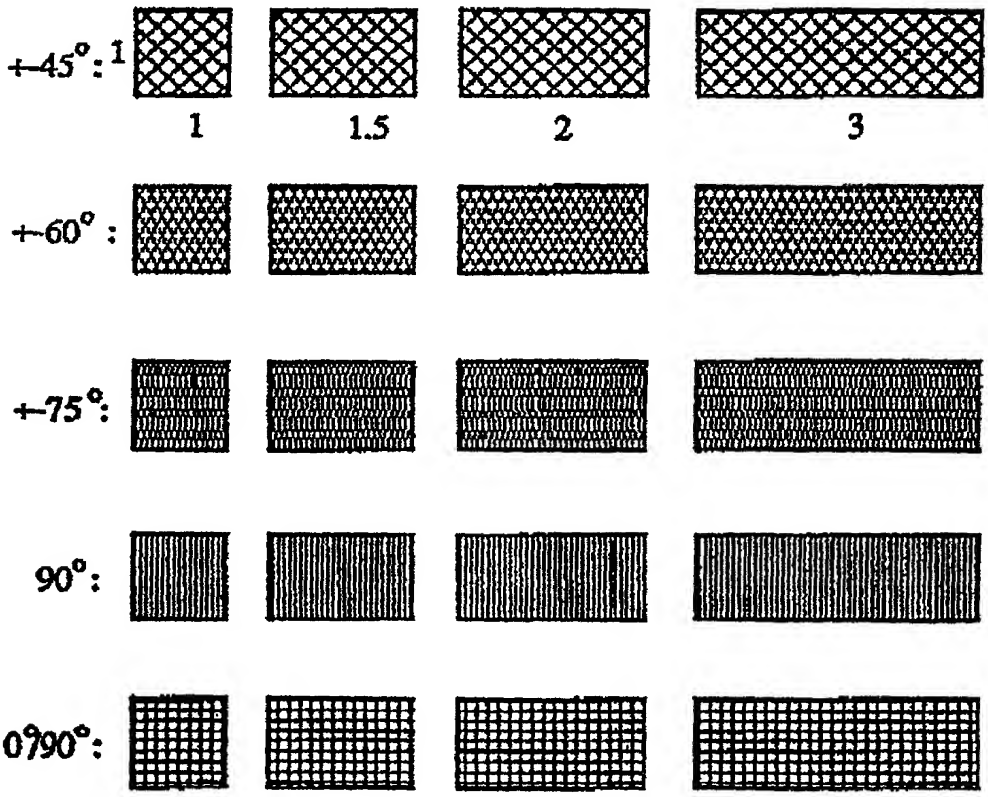

Fig. 2

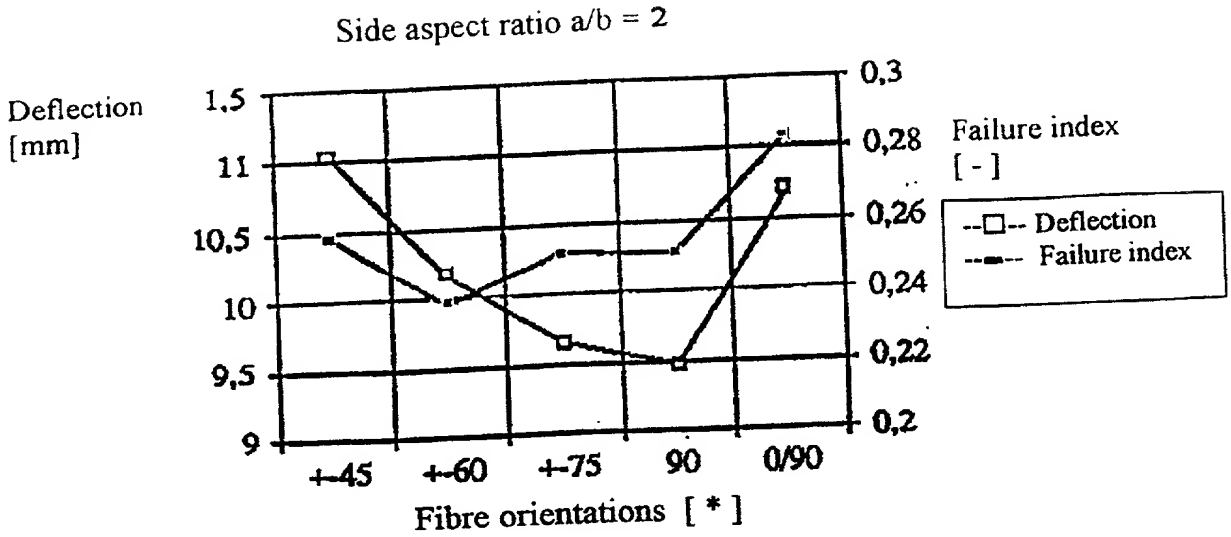
Side aspect ratio a/b = 2
Deflection [mm]
1,5
11
10,5
10
9,5
9
0,3
0,28
0,26
0,24
0,22
0,2
Failure index [-]
--□-- Deflection
--■-- Failure index
+-45
+-60
+-75
90
0/90
Fibre orientations [*]

Fig. 5

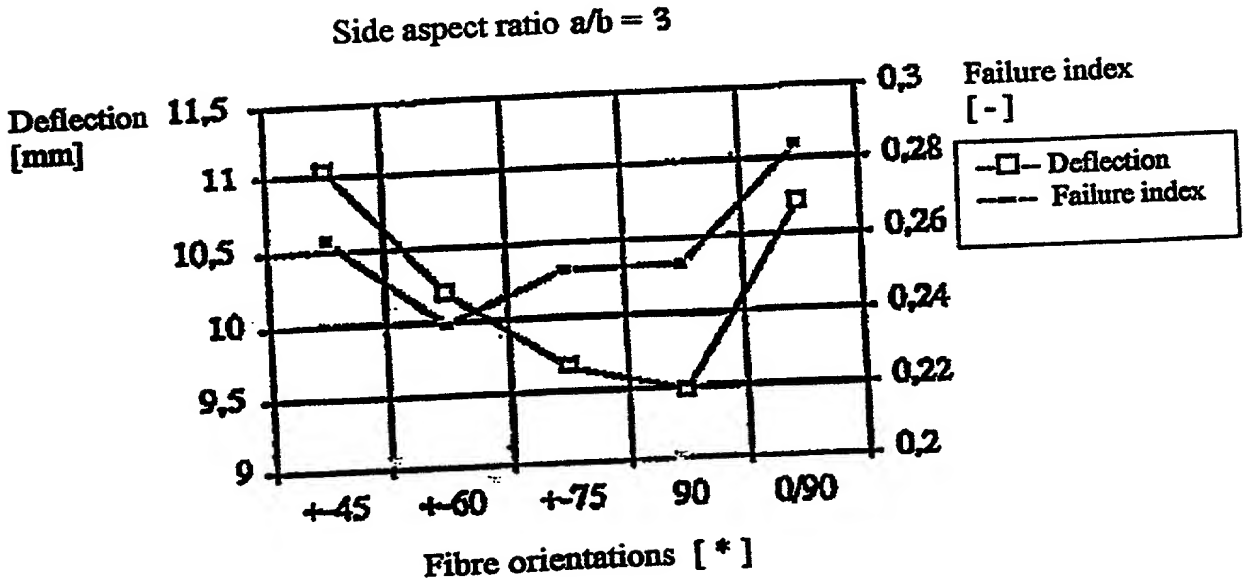
Side aspect ratio a/b = 3
Deflection [mm]
11,5
11
10,5
10
9,5
9
0,3
0,28
0,26
0,24
0,22
0,2
Failure index [-]
--□-- Deflection
—■— Failure index
+-45
+-60
+-75
90
0/90
Fibre orientations [*]

Fig. 6

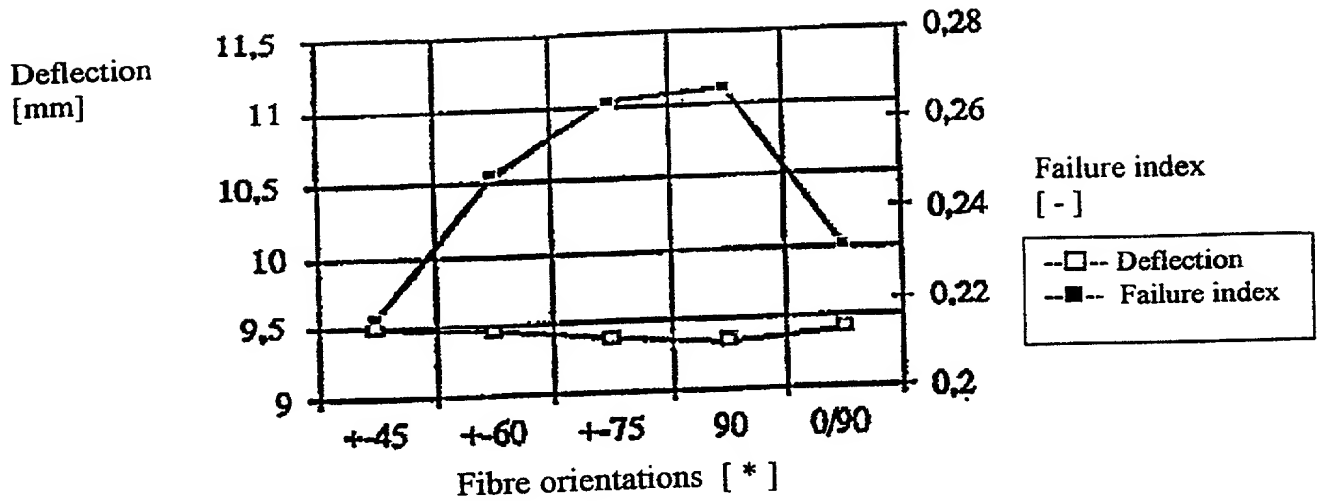

Fig. 3

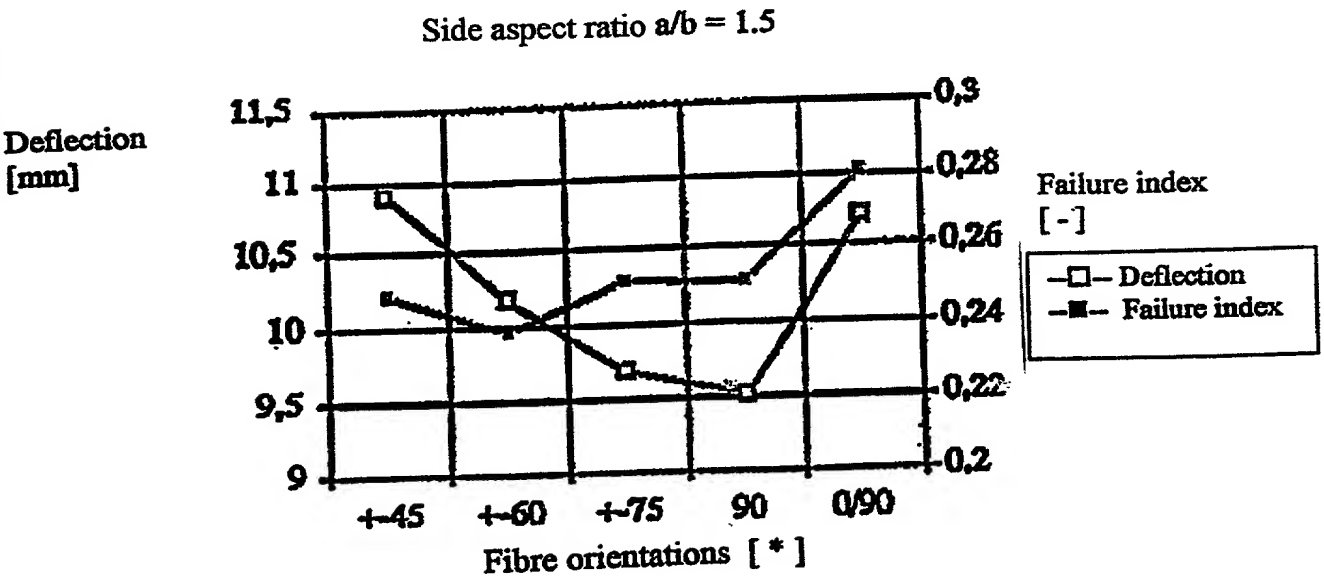

Fig. 4

30-516_

Nixon & Vanderhye P.C. (10/99)
(Domestic Non-Assigned/Foreign)

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PRESSURE-LOADED PANEL AND USE OF IT AT BOAT OR CONTAINER CONSTRUCTIONS

the specification of which (**check** applicable **box(s)**):

☐ is attached hereto
☐ was filed on _____ as U.S. Application Serial No. _____ (Atty Dkt. No. **30-516**)
☒ was filed as PCT International application No. **PCT/FI98/00737** on **18 September 1998**
and (if applicable to U.S. or PCT application) was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	**Country**	**Day/Month/Year Filed**
973721	**Finland**	**18 September 1997**

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	**Date/Month/Year Filed**

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below and, insofar as the subject matter of each of the claims of this application is not disclosed in such prior applications in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. 1.56 which occurred between the filing date of the prior applications and the national or PCT international filing date of this application:

Prior U.S./PCT Application(s): **Application Serial No.**	**Day/Month/Year Filed**	**Status: patented pending, abandoned**
PCT/FI98/00737	**18 September 1998**	Pending

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint **NIXON & VANDERHYE P.C., 1100 North Glebe Rd., 8th Floor, Arlington, VA 22201-4714, telephone number (703) 816-4000 (to whom all communications are to be directed)**, and the following attorneys thereof (of the same address) individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent: Arthur R. Crawford, 25327; Larry S. Nixon, 25640; Robert A. Vanderhye, 27076; James T. Hosmer, 30184; Robert W. Faris, 31352; Richard G. Besha, 22770; Mark E. Nusbaum, 32348; Michael J. Keenan, 32106; Bryan H. Davidson, 30251; Stanley C. Spooner, 27393; Leonard C. Mitchard, 29009; Duane M. Byers, 33363; Jeffry H. Nelson, 30481, John R. Lastova, 33149; H. Warren Burnam, Jr. 29366; Thomas E. Byrne, 32205; Mary J. Wilson, 32955; J. Scott Davidson, 33489; Alan M. Kagen, 36178; Robert A. Molan, 29834; B. J. Sadoff, 36663; James D. Berquist, 34776; Updeep S. Gill, 37334, Michael J. Shea, 34725; Donald L. Jackson, 41090; Michelle N. Lester, 32331; Frank P. Presta, 19828; Joseph S. Presta, 35329; Joseph A. Rhoa, 37515 I also authorize Nixon & Vanderhye to delete any attorney names/numbers no longer with the firm and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

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FOR ADDITIONAL INVENTORS, check box ☐ and attach sheet with same information and signature and date for each.